

10/539560

JC17 Rec'd PCT/PTO 17 JUN 2005

SEQUENCE LISTING

<110> MITSUI CHEMICALS, INC.

<120> A novel nitrile hydratase

<130> F000286

<160> 139

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<212> PRT

<213> Pseudonocardia thermophila

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/strain="JCM3095"

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/product="nitrile hydratase alpha subunit"

<400> 1

Met Thr Glu Asn Ile Leu Arg Lys Ser Asp Glu Glu Ile Gln Lys Glu

5

10

15

Ile Thr Ala Arg Val Lys Ala Leu Glu Ser Met Leu Ile Glu Gln Gly

20

25

30

Ile Leu Thr Thr Ser Met Ile Asp Arg Met Ala Glu Ile Tyr Glu Asn

35

40

45

Glu Val Gly Pro His Leu Gly Ala Lys Val Val Val Lys Ala Trp Thr

50

55

60

Asp Pro Glu Phe Lys Lys Arg Leu Leu Ala Asp Gly Thr Glu Ala Cys

65

70

75

80

Lys Glu Leu Gly Ile Gly Gly Leu Gln Gly Glu Asp Met Met Trp Val

85

90

95

Glu Asn Thr Asp Glu Val His His Val Val Val Cys Thr Leu Cys Ser

100

105

110

Cys Tyr Pro Trp Pro Val Leu Gly Leu Pro Pro Asn Trp Phe Lys Glu

115

120

125

Pro Gln Tyr Arg Ser Arg Val Val Arg Glu Pro Arg Gln Leu Leu Lys

130

135

140

Glu Glu Phe Gly Phe Glu Val Pro Pro Ser Lys Glu Ile Lys Val Trp

145

150

155

160

Asp Ser Ser Ser Glu Met Arg Phe Val Val Leu Pro Gln Arg Pro Ala

175

190

-205

<213> *Pseudonocardia thermophila*

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/product="nitrile hydratase beta subunit"
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15

Asn Arg Pro Ala Asp Glu Pro Val Phe Arg Ala Glu Trp Glu Lys Val

20

25

30

Ala Phe Ala Met Phe Pro Ala Thr Phe Arg Ala Gly Phe Met Gly Leu

35

40

45

Asp Glu Phe Arg Phe Gly Ile Glu Gln Met Asn Pro Ala Glu Tyr Leu

50

55

60

Glu Ser Pro Tyr Tyr Trp His Trp Ile Arg Thr Tyr Ile His His Gly

65

70

75

80

Val Arg Thr Gly Lys Ile Asp Leu Glu Glu Leu Glu Arg Arg Thr Gln

85

90

95

Tyr Tyr Arg Glu Asn Pro Asp Ala Pro Leu Pro Glu His Glu Gln Lys

100

105

110

Pro Glu Leu Ile Glu Phe Val Asn Gln Ala Val Tyr Gly Gly Leu Pro

115

120

125

Ala Ser Arg Glu Val Asp Arg Pro Pro Lys Phe Lys Glu Gly Asp Val

130

135

140

Val Arg Phe Ser Thr Ala Ser Pro Lys Gly His Ala Arg Arg Ala Arg

145

150

155

160

Tyr Val Arg Gly Lys Thr Gly Thr Val Val Lys His His Gly Ala Tyr

	165	170	175
Ile Tyr Pro Asp Thr Ala Gly Asn Gly Leu Gly Glu Cys Pro Glu His			
	180	185	190
Leu Tyr Thr Val Arg Phe Thr Ala Gln Glu Leu Trp Gly Pro Glu Gly			
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Asp Pro Asn Ser Ser Val Tyr Tyr Asp Cys Trp Glu Pro Tyr Ile Glu			
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Leu Val Asp Thr Lys Ala Ala Ala Ala			
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cggatggccg agatctacga gaacgaggtc ggcccgcacc tcggcgcgaa ggtcgtcgtg 180
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gactccagct ccgagatgcg ctctgctgct ctcccgcagc gccccgcggg caccgacggg 540
tggagcgagg aggagctcgc caccctcgtc acccgcgagt cgatgatcgg cgtcgaaccg 600
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ttccggggccg gcttcatggg cctggacgag ttccgggttcg gcatcgagca gatgaaccgc 180
gccgagtacc tcgagtcgcc gtactactgg cactggatcc gcacctacat ccaccacggc 240
gtccgcaccg gcaagatcga tctcgaggag ctggagcgcc gcacgcagta ctaccgggag 300
aaccgacg ccccgctgcc cgagcacgag cagaagccgg agttgatcga gttcgtcaac 360
caggccgtct acggcgggct gcccgcaagc cgggaggtcg accgaccgcc caagttcaag 420

gagggcgacg tgggtgcggtt ctccaccgcg agcccgaagg gccacgcccg gcgcgcgcgg 480
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/strain="JCM3095"

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<222> 1..144

<223> /gene="gene encoding protein participation in the activation of nitrile hydratase"

/product="protein participation in the activation of nitrile"

hydratase"

<220>

<221> INT#MET

<222> 1

<400> 5

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Asp Arg Ala Ala Ala Asp Ala Leu Leu Ala Gln Leu Pro Gly Gly Asp
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Arg Ala Leu Asp Arg Gly Phe Asp Glu Pro Trp Gln Leu Arg Ala Phe
35 40 45

Ala Leu Ala Val Ala Ala Cys Arg Ala Gly Arg Phe Glu Trp Lys Gln
50 55 60

Leu Gln Gln Ala Leu Ile Ser Ser Ile Gly Glu Trp Glu Arg Thr His
65 70 75 80

Asp Leu Asp Asp Pro Ser Trp Ser Tyr Tyr Glu His Phe Val Ala Ala
85 90 95

Leu Glu Ser Val Leu Gly Glu Glu Gly Ile Val Glu Pro Glu Ala Leu
100 105 110

Asp Glu Arg Thr Ala Glu Val Leu Ala Asn Pro Pro Asn Lys Asp His

115

120

125

His Gly Pro His Leu Glu Pro Val Ala Val His Pro Ala Val Arg Ser

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135

140

<210> 6

<211> 435

<212> DNA

<213> *Pseudonocardia thermophila*

<220>

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nitrile hydratase"

/product="protein participation in the activation of nitrile
hydratase"

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gagccgtggc agctgcgggc gticgcgctg gcggtcgcg cgtgcagggc gggccggttc 180
gagtggaaagc agctgcagca ggcgctgac tcctcgatcg gggagtggga gcgcacccac 240
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ctcggcgagg aagggatcgt cgagccggag gcgctggacg agcgcaccgc ggaggtcttg 360
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17

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18

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<220>

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18

<210> 74

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<400> 77

gacgaggccc ggttcggc

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<210> 85

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<213> Artificial Sequence

<220>

<223> Oligonucleotide to act as a PCR primer

<400> 85

ggcggggtgc ccgcaagc

18

<210> 86

<211> 18

<212> DNA

<213> Artificial Sequence

<220>

<223> Oligonucleotide to act as a PCR primer

<400> 86

ggcgggtcgc ccgcaagc

18

<210> 87

<211> 18

<212> DNA

<213> Artificial Sequence

<220>

<223> Oligonucleotide to act as a PCR primer

<400> 87

gtggtggggt tctccacc

18

<210> 88

<211> 18

<212> DNA

<213> Artificial Sequence

<220>

<223> Oligonucleotide to act as a PCR primer

<400> 88

cgcgcgctgt acgtgcgc

18

<210> 89

<211> 18

<212> DNA

<213> Artificial Sequence

<220>

<223> Oligonucleotide to act as a PCR primer

<400> 89

cgcgcggtgt acgtgcgc

18

<210> 90

<211> 18

<212> DNA

<213> Artificial Sequence

<220>

<223> Oligonucleotide to act as a PCR primer

<400> 90

aacggcgagg gcgagtgc

18

<210> 91

<211> 18

<212> DNA

<213> Artificial Sequence

<220>

<223> Oligonucleotide to act as a PCR primer

<400> 91

aacggcgatg gcgagtgc

18

<210> 92

<211> 18

<212> DNA

<213> Artificial Sequence

<220>

<223> Oligonucleotide to act as a PCR primer

<400> 92

aacggcaagg gcgagtgc

18

<210> 93

<211> 18

<212> DNA

<213> Artificial Sequence

<220>

<223> Oligonucleotide to act as a PCR primer

<400> 93

aacggccggg gcgagtgc

18

<210> 94

<211> 18

<212> DNA

<213> Artificial Sequence

<220>

<223> Oligonucleotide to act as a PCR primer

<400> 94

aacggcaacg gcgagtgc

18

<210> 95

<211> 18

<212> DNA

<213> Artificial Sequence

<220>

<223> Oligonucleotide to act as a PCR primer

<400> 95

aacggctcgg gcgagtgc

18

<210> 96

<211> 18

<212> DNA

<213> Artificial Sequence

<220>

<223> Oligonucleotide to act as a PCR primer

<400> 96

aacggcgggg gcgagtgc

18

<210> 97

<211> 18

<212> DNA

<213> Artificial Sequence

<220>

<223> Oligonucleotide to act as a PCR primer

<400> 97

tactacggct gctgggag

18

<210> 98

<211> 205

<212> PRT

<213> Pseudonocardia thermophila

<220>

<221> source

<222> 1..205

<223> /organism="Pseudonocardia thermophila"
/strain="JCM3095"

<220>

<221> CDS

<222> 1..205

<223> /gene="nitrile hydratase alpha subunit"
/product="nitrile hydratase alpha subunit"

<400> 98

Met Thr Glu Asn Ile Leu Arg Lys Ser Asp Glu Glu Ile Gln Lys Glu

5

10

15

Ile Thr Ala Arg Val Lys Ala Leu Glu Ser Met Leu Ile Glu Gln Gly
20 25 30

Ile Leu Thr Thr Ser Met Ile Asp Arg Met Ala Glu Ile Tyr Glu Asn
35 40 45

Glu Val Gly Pro His Leu Gly Ala Lys Val Val Val Lys Ala Trp Thr
50 55 60

Asp Pro Glu Phe Lys Lys Arg Leu Leu Ala Asp Gly Thr Glu Ala Cys
65 70 75 80

Lys Glu Leu Gly Ile Gly Gly Leu Gln Gly Glu Asp Met Met Trp Val
85 90 95

Glu Asn Thr Asp Glu Val His His Val Val Val Cys Thr Leu Cys Ser
100 105 110

Cys Tyr Pro Trp Pro Val Leu Gly Leu Pro Pro Asn Trp Phe Lys Glu
115 120 125

Pro Gln Tyr Arg Ser Arg Val Val Arg Glu Pro Arg Gln Leu Leu Lys
130 135 140

Glu Glu Phe Gly Phe Glu Val Pro Pro Ser Lys Glu Ile Lys Val Trp
145 150 155 160

Asp Ser Ser Ser Glu Met Arg Phe Val Val Leu Pro Gln Arg Pro Ala
165 170 175

Gly Thr Asp Gly Trp Ser Glu Glu Glu Leu Ala Thr Leu Val Thr Arg
180 185 190

Glu Ser Met Ile Gly Val Glu Pro Ala Lys Ala Val Ala
195 200 205

<210> 99

<211> 223

<212> PRT

<213> Pseudonocardia thermophila

<220>

<221> source

<222> 1..223

<223> /organism="Pseudonocardia thermophila"
/strain="JCM3095"

<220>

<221> CDS

<222> 1..223

<223> /gene="nitrile hydratase beta subunit"
/product="nitrile hydratase beta subunit"

<400> 99

Met Asn Gly Val Tyr Asp Val Gly Gly Thr Asp Gly Leu Gly Pro Ile
5 10 15

Asn Arg Pro Ala Asp Glu Pro Val Phe Arg Ala Glu Trp Glu Lys Val
20 25 30

Ala Phe Ala Met Phe Pro Ala Thr Phe Arg Ala Gly Phe Met Gly Leu
35 40 45

Asp Glu Phe Arg Phe Gly Ile Glu Gln Met Asn Pro Ala Glu Tyr Leu
50 55 60

Glu Ser Pro Tyr Tyr Trp His Trp Ile Arg Thr Tyr Ile His His Gly
65 70 75 80

Val Arg Thr Gly Lys Ile Asp Leu Glu Glu Leu Glu Arg Arg Thr Gln
85 90 95

Tyr Tyr Arg Glu Asn Pro Asp Ala Pro Leu Pro Glu His Glu Gln Lys
100 105 110

Pro Glu Leu Ile Glu Phe Val Asn Gln Ala Val Tyr Gly Gly Leu Pro
115 120 125

Ala Ser Arg Glu Val Asp Arg Pro Pro Lys Phe Lys Glu Gly Asp Val
130 135 140

Val Arg Phe Ser Thr Ala Ser Pro Lys Gly His Ala Arg Arg Ala Arg
145 150 155 160

Tyr Val Arg Gly Lys Thr Gly Thr Val Val Lys His His Gly Ala Tyr
165 170 175

Ile Tyr Pro Asp Thr Ala Gly Asn Gly Leu Gly Glu Cys Pro Glu His

180

185

190

Leu Tyr Thr Val Arg Phe Thr Ala Gln Glu Leu Trp Gly Pro Glu Gly

195

200

205

Asp Pro Asn Ser Ser Val Tyr Tyr Asp Cys Trp Glu Pro Tyr Ile Glu

210

215

220

Leu Val Asp Thr Lys Ala Ala Ala Ala

225

230

233

<210> 100

<211> 618

<212> DNA

<213> Pseudonocardia thermophila

<220>

<221> source

<222> 1..618

<223> /organism="Pseudonocardia thermophila"
/strain="JCM3095"

<220>

<221> CDS

<222> 1..618

<223> /gene="nitrile hydratase alpha subunit"

/product=" nitrile hydratase alpha subunit"

<400> 100

atgaccgaga acatcctgcg caagtcggac gaggagatcc agaaggagat cacggcgcg 60
gtcaaggccc tggagtcgat gctcatcgaa cagggcaccc tcaccacgtc gatgatcgac 120
cggatggccg agatctacga gaacgaggtc ggcccgcacc tcggcgcgaa ggtcgtcgtg 180
aaggcctgga ccgacccgga gttcaagaag cgtctgctcg ccgacggcac cgaggcctgc 240
aaggagctcg gcatcggcgg cctgcagggc gaggacatga tgtgggtgga gaacaccgac 300
gaggtccacc acgtcgtcgt gtgcacgctc tgctcctgct acccgtggcc ggtgctgggg 360
ctgccgccga actggttcaa ggagccgcag taccgctccc gcgtgggtcg tgagccccgg 420
cagctgctca aggaggagtt cggcttcgag gtcccgccga gcaaggagat caaggtctgg 480
gactccagct ccgagatgcg cttcgtcgtc ctcccgcagc gccccgcggg caccgacggg 540
tggagcgagg aggagctcg caccctcgtc acccgcgagt cgatgatcgg cgtcgaaccg 600
gcgaaggcgg tcgcgtga 618

<210> 101

<211> 702

<212> DNA

<213> Pseudonocardia thermophila

<220>

<221> source

<222> 1..702

<223> /organism="Pseudonocardia thermophila"
/strain="JCM3095"

<220>

<221> CDS

<222> 1..702

<223> /gene="nitrile hydratase beta subunit"
/product="nitrile hydratase beta subunit"

<400> 101

atgaacggcg tgtacgacgt cggcggcacc gatgggctgg gcccgatcaa ccggcccgcg 60

gacgaaccgg tcttccgcgc cgagtgggag aaggtcgcgt tcgcgatgtt cccggcgacg 120

ttccgggccg gcttcatggg cctggacgag ttccggttcg gcatcgagca gatgaaccgc 180

gccgagtacc tcgagtcgcc gtactactgg cactggatcc gcacctacat ccaccacggc 240

gtccgcaccg gcaagatcga tctcgaggag ctggagcgcc gcacgcagta ctaccgggag 300

aaccccgacg ccccgctgcc cgagcacgag cagaagccgg agttgatcga gttcgtcaac 360

caggccgtct acggcgggct gcccgcaagc cgggaggtcg accgaccgcc caagttcaag 420

gagggcgacg tgggtcggtt ctccaccgcg agcccgaagg gccacgcccg gcgcgcgcgg 480

tacgtgcgcg gcaagaccgg gacggtggtc aagcaccacg gcgcgtacat ctaccggac 540

accgccggca acggcctggg cgagtgcgcc gagcacctct acaccgtccg cttcacggcc 600

caggagctgt gggggccgga aggggacccg aactccagcg tctactacga ctgctgggag 660

ccctacatcg agctcgtcga cacgaaggcg gccgcggcat ga 702

<210> 102

<211> 144

<212> PRT

<213> Pseudonocardia thermophila

<220>

<221> source

<222> 1..144

<223> /organism="Pseudonocardia thermophila"
/strain="JCM3095"

<220>

<221> CDS

<222> 1..144

<223> /gene="gene encoding protein participation in the activation of
nitrile hydratase"

/product="protein participation in the activation of nitrile
hydratase"

<220>

<221> INT#MET

<222> 1

<400> 102

Met Ser Ala Glu Ala Lys Val Arg Leu Lys His Cys Pro Thr Ala Glu
1 5 10 15

Asp Arg Ala Ala Ala Asp Ala Leu Leu Ala Gln Leu Pro Gly Gly Asp
20 25 30

Arg Ala Leu Asp Arg Gly Phe Asp Glu Pro Trp Gln Leu Arg Ala Phe
35 40 45

Ala Leu Ala Val Ala Ala Cys Arg Ala Gly Arg Phe Glu Trp Lys Gln
50 55 60

Leu Gln Gln Ala Leu Ile Ser Ser Ile Gly Glu Trp Glu Arg Thr His
65 70 75 80

Asp Leu Asp Asp Pro Ser Trp Ser Tyr Tyr Glu His Phe Val Ala Ala
85 90 95

Leu Glu Ser Val Leu Gly Glu Glu Gly Ile Val Glu Pro Glu Ala Leu
100 105 110

Asp Glu Arg Thr Ala Glu Val Leu Ala Asn Pro Pro Asn Lys Asp His

115

120

125

His Gly Pro His Leu Glu Pro Val Ala Val His Pro Ala Val Arg Ser
130 135 140

<210> 103

<211> 435

<212> DNA

<213> *Pseudonocardia thermophila*

<220>

<221> source

<222> 1..435

<223> /organism="Pseudonocardia thermophila"
/strain="JCM3095"

<220>

<221> CDS

<222> 1..435

<223> /gene="gene encoding protein participation in the activation of
nitrile hydratase"

/product="protein participation in the activation of nitrile
hydratase"

<220>

<221> init_codon

<222> 1..3

<220>

<221> g or a

<222> 1..1

<400> 103

rtgagcgccg aggccaaggt ccgcctgaag cactgccccca cggccgagga ccgggcggcg 60

gccgacgcgc tgctcgcgca gctgcccggc ggcgaccgcg cgctcgaccg cggcttcgac 120

gagccgtggc agctgcgggc gttcgcgctg gcggtcgcg cgctgcaggc gggccggttc 180

gagtggaagc agctgcagca ggcgctgac tcctcgatcg gggagtggga gcgcacccac 240

gatctcgacg atccgagctg gtcctactac gagcattcg tcgccgcgct ggaatccgtg 300

ctcggcgagg aagggatcgt cgagccggag gcgctggacg agcgcaccgc ggaggtcttg 360

gccaaccgc cgaacaagga tcacatgga ccgcatttg agcccgtcgc ggtccaccgc 420

gccgtgcggt cctga 435

<210> 104

<211> 1315

<212> DNA

<213> Rhodococcus rhodochrous

<220>

<221> source

<222> 1.. 1315

<223> /organism="Rhodococcus rhodochrous"

/strain="J1 (FERM BP-1478)"

<220>

<221> CDS

<222> 1..690

<223> /gene="nitrile hydratase beta subunit"

/product="nitrile hydratase beta subunit"

<220>

<221> CDS

<222> 704..1315

<223> /gene="nitrile hydratase alpha subunit"

/product="nitrile hydratase alpha subunit"

<400> 104

atg gat ggt atc cac gac aca ggc ggc atg acc gga tac gga ccg gtc 48

Met Asp Gly Ile His Asp Thr Gly Gly Met Thr Gly Tyr Gly Pro Val

1 5 10 15

ccc tat cag aag gac gag ccc ttc ttc cac tac gag tgg gag ggt cgg 96

Pro Tyr Gln Lys Asp Glu Pro Phe Phe His Tyr Glu Trp Glu Gly Arg

20 25 30

acc ctg tca att ctg act tgg atg cat ctc aag ggc ata tcg tgg tgg 144

Thr Leu Ser Ile Leu Thr Trp Met His Leu Lys Gly Ile Ser Trp Trp

35 40 45

gac aag tcg cgg ttc ttc cgg gag tcg atg ggg aac gaa aac tac gtc 192

Asp Lys Ser Arg Phe Phe Arg Glu Ser Met Gly Asn Glu Asn Tyr Val
50 55 60

aac gag att cgc aac tcg tac tac acc cac tgg ctg agt gcg gca gaa 240
Asn Glu Ile Arg Asn Ser Tyr Tyr Thr His Trp Leu Ser Ala Ala Glu
65 70 75 80

cgt atc ctc gtc gcc gac aag atc atc acc gaa gaa gag cga aag cac 288
Arg Ile Leu Val Ala Asp Lys Ile Ile Thr Glu Glu Glu Arg Lys His
85 90 95

cgt gtg caa gag atc ctt gag ggt cgg tac acg gac agg aag ccg tcg 336
Arg Val Gln Glu Ile Leu Glu Gly Arg Tyr Thr Asp Arg Lys Pro Ser
100 105 110

cgg aag ttc gat ccg gcc cag atc gag aag gcg atc gaa cgg ctt cac 384
Arg Lys Phe Asp Pro Ala Gln Ile Glu Lys Ala Ile Glu Arg Leu His
115 120 125

gag ccc cac tcc cta gcg ctt cca gga gcg gag ccg agt ttc tct ctc 432
Glu Pro His Ser Leu Ala Leu Pro Gly Ala Glu Pro Ser Phe Ser Leu
130 135 140

ggt gac aag atc aaa gtg aag agt atg aac ccg ctg gga cac aca cgg 480
Gly Asp Lys Ile Lys Val Lys Ser Met Asn Pro Leu Gly His Thr Arg
145 150 155 160

tgc ccg aaa tat gtg cgg aac aag atc ggg gaa atc gtc gcc tac cac 528
Cys Pro Lys Tyr Val Arg Asn Lys Ile Gly Glu Ile Val Ala Tyr His

165	170	175	
ggc tgc cag atc tat ccc gag agc agc tcc gcc ggc ctc ggc gac gat			576
Gly Cys Gln Ile Tyr Pro Glu Ser Ser Ser Ala Gly Leu Gly Asp Asp			
180	185	190	
cct cgc ccg ctc tac acg gtc gcg ttt tcc gcc cag gaa ctg tgg ggc			624
Pro Arg Pro Leu Tyr Thr Val Ala Phe Ser Ala Gln Glu Leu Trp Gly			
195	200	205	
gac gac gga aac ggg aaa gac gta gtg tgc gtc gat ctc tgg gaa ccg			672
Asp Asp Gly Asn Gly Lys Asp Val Val Cys Val Asp Leu Trp Glu Pro			
210	215	220	
tac ctg atc tct gcg tga aaggaatacg ata gtg agc gag cac gtc aat			720
Tyr Leu Ile Ser Ala ***		Met Ser Glu His Val Asn	
225	229	1	5
aag tac acg gag tac gag gca cgt acc aag gcg atc gaa acc ttg ctg			768
Lys Tyr Thr Glu Tyr Glu Ala Arg Thr Lys Ala Ile Glu Thr Leu Leu			
10	15	20	
tac gag cga ggg ctc atc acg ccc gcc gcg gtc gac cga gtc gtt tcg			816
Tyr Glu Arg Gly Leu Ile Thr Pro Ala Ala Val Asp Arg Val Val Ser			
25	30	35	
tac tac gag aac gag atc ggc ccg atg ggc ggt gcc aag gtc gtg gcc			864
Tyr Tyr Glu Asn Glu Ile Gly Pro Met Gly Gly Ala Lys Val Val Ala			
40	45	50	

aag tcc tgg gtg gac cct gag tac cgc aag tgg ctc gaa gag gac gcg 912
Lys Ser Trp Val Asp Pro Glu Tyr Arg Lys Trp Leu Glu Glu Asp Ala
55 60 65 70

att tcg gcg gtc ttc aac gac tcc caa acg cat cac gtg gtg gtg tgc 1008
Ile Ser Ala Val Phe Asn Asp Ser Gln Thr His His Val Val Val Cys
90 95 100

tgg tac aag agc atg gag tac cgg tcc cga gtg gta gcg gac cct cgt 1104
Trp Tyr Lys Ser Met Glu Tyr Arg Ser Arg Val Val Ala Asp Pro Arg
120 125 130

gtc agg gtt tgg gac agc agc tcc gaa atc cgc tac atc gtc atc ccg 1200
Val Arg Val Trp Asp Ser Ser Ser Glu Ile Arg Tyr Ile Val Ile Pro
155 160 165

gaa cgg ccg gcc ggc acc gac ggt tgg tcc gag gag gag ctg acg aag 1248

Glu Arg Pro Ala Gly Thr Asp Gly Trp Ser Glu Glu Glu Leu Thr Lys

170

175

180

ctg gtg agc cgg gac tcg atg atc ggt gtc agt aat gcg ctc aca ccg 1296

Leu Val Ser Arg Asp Ser Met Ile Gly Val Ser Asn Ala Leu Thr Pro

185

190

195

cag gaa gtg atc gta tga

1315

Gln Glu Val Ile Val ***

200

203

<210> 105

<211> 29

<212> DNA

<213> Artificial Sequence

<220>

<223> Oligonucleotide to act as a PCR primer

<400> 105

ccggaattcg aaaggaatga ggaaatgga

29

<210> 106

<211> 28

<212> DNA

<213> Artificial Sequence

<220>

<223> Oligonucleotide to act as a PCR primer

<400> 106

aaaaagtact catacgatca cttcctgc

28

<210> 107

<211> 17

<212> DNA

<213> Artificial Sequence

<220>

<223> Oligonucleotide to act as a PCR primer

<400> 107

gttttcccag tcacgac

17

<210> 108

<211> 20

<212> DNA

<213> Artificial Sequence

<220>

<223> Oligonucleotide to act as a PCR primer

<400> 108

ggccagtgcc tagcttacat

20

<210> 109

<211> 17

<212> DNA

<213> Artificial Sequence

<220>

<223> Oligonucleotide to act as a PCR primer

<400> 109

caggaaacag ctatgac

17

<210> 110

<211> 29

<212> DNA

<213> Artificial Sequence

<220>

<221> Any

<222> 14..16

<223> Oligonucleotide to act as a PCR primer

<400> 110

gggcatatcg tggnnngaca agtcgcggt

29

<210> 111

<211> 18

<212> DNA

<213> Artificial Sequence

<220>

<221> Any

<222> 7..9

<223> Oligonucleotide to act as a PCR primer

<400> 111

ctcaccnnnt cgatgatc

18

<210> 112

<211> 18

<212> DNA

<213> Artificial Sequence

<220>

<221> Any

<222> 7..9

<223> Oligonucleotide to act as a PCR primer

<400> 112

tacgagnnng aggtcggc

18

<210> 113

<211> 18

<212> DNA

<213> Artificial Sequence

<220>

<221> Any

<222> 7..9

<223> Oligonucleotide to act as a PCR primer

<400> 113

aagaagnnnc tgctcgcc

18

<210> 114

<211> 18

<212> DNA

<213> Artificial Sequence

<220>

<221> Any

<222> 7..9

<223> Oligonucleotide to act as a PCR primer

<400> 114

gagttcnnnt tcgaggtc

18

<210> 115

<211> 18

<212> DNA

<213> Artificial Sequence

<220>

<221> Any

<222> 7..9

<223> Oligonucleotide to act as a PCR primer

<400> 115

ctcgccnnnc tcgtcact

18

<210> 116

<211> 18

<212> DNA

<213> Artificial Sequence

<220>

<221> Any

<222> 7..9

<223> Oligonucleotide to act as a PCR primer

<400> 116

aaggcgnnng cgtgagcg

18

<210> 117

<211> 18

<212> DNA

<213> Artificial Sequence

<220>

<221> Any

<222> 7..9

<223> Oligonucleotide to act as a PCR primer

<400> 117

ggcggcnnng atgggctg

18

<210> 118

<211> 18

<212> DNA

<213> Artificial Sequence

<220>

<221> Any

<222> 7..9

<223> Oligonucleotide to act as a PCR primer

<400> 118

gagaagnnng cgttcgcg

18

<210> 119

<211> 18

<212> DNA

<213> Artificial Sequence

<220>

<221> Any

<222> 7..9

<223> Oligonucleotide to act as a PCR primer

<400> 119

aaggtcnnnt tcgcgatg

18

<210> 120

<211> 18

<212> DNA

<213> Artificial Sequence

<220>

<221> Any

<222> 7..9

<223> Oligonucleotide to act as a PCR primer

<400> 120

gcgatgnnnc cggcgacg

18

<210> 121

<211> 18

<212> DNA

<213> Artificial Sequence

<220>

<221> Any

<222> 7..9

<223> Oligonucleotide to act as a PCR primer

<400> 121

ccggcgnnnt tccgggcc

18

<210> 122

<211> 18

<212> DNA

<213> Artificial Sequence

<220>

<221> Any

<222> 7..9

<223> Oligonucleotide to act as a PCR primer

<400> 122

gcgacgnnnc gggccggc

18

<210> 123

<211> 18

<212> DNA

<213> Artificial Sequence

<220>

<221> Any

<222> 7..9

<223> Oligonucleotide to act as a PCR primer

<400> 123

ggcttcnnng gcctggac

18

<210> 124

<211> 18

<212> DNA

<213> Artificial Sequence

<220>

<221> Any

<222> 7..9

<223> Oligonucleotide to act as a PCR primer

<400> 124

atgggcnnng acgagttc

18

<210> 125

<211> 18

<212> DNA

<213> Artificial Sequence

<220>

<221> Any

<222> 7..9

<223> Oligonucleotide to act as a PCR primer

<400> 125

gacgagnnnc ggttcggc

18

<210> 126

<211> 18

<212> DNA

<213> Artificial Sequence

<220>

<221> Any

<222> 7..9

<223> Oligonucleotide to act as a PCR primer

<400> 126

aacccgnnng agtacctc

18

<210> 127

<211> 18

<212> DNA

<213> Artificial Sequence

<220>

<221> Any

<222> 7..9

<223> Oligonucleotide to act as a PCR primer

<400> 127

tggcacnna tccgcacc

18

<210> 128

<211> 18

<212> DNA

<213> Artificial Sequence

<220>

<221> Any

<222> 7..9

<223> Oligonucleotide to act as a PCR primer

<400> 128

gagcagnnnc cggagttg

18

<210> 129

<211> 18

<212> DNA

<213> Artificial Sequence

<220>

<221> Any

<222> 7..9

<223> Oligonucleotide to act as a PCR primer

<400> 129

atcgagnnng tcaaccag

18

<210> 130

<211> 18

<212> DNA

<213> Artificial Sequence

<220>

<221> Any

<222> 7..9

<223> Oligonucleotide to act as a PCR primer

<400> 130

ggcgggnnnc ccgcaagc

18

<210> 131

<211> 18

<212> DNA

<213> Artificial Sequence

<220>

<221> Any

<222> 7..9

<223> Oligonucleotide to act as a PCR primer

<400> 131

gtggtgnnt tctccacc

18

<210> 132

<211> 18

<212> DNA

<213> Artificial Sequence

<220>

<221> Any

<222> 7..9

<223> Oligonucleotide to act as a PCR primer

<400> 132

tccaccnna gcccgaaag

18

<210> 133

<211> 18

<212> DNA

<213> Artificial Sequence

<220>

<221> Any

<222> 7..9

<223> Oligonucleotide to act as a PCR primer

<400> 133

cgcgcgnnt acgtgcgc

18

<210> 134

<211> 18

<212> DNA

<213> Artificial Sequence

<220>

<221> Any

<222> 7..9

<223> Oligonucleotide to act as a PCR primer

<400> 134

accgggnnng tggtaag

18

<210> 135

<211> 18

<212> DNA

<213> Artificial Sequence

<220>

<221> Any

<222> 7..9

<223> Oligonucleotide to act as a PCR primer

<400> 135

gtggtcnnnc accacggc

18

<210> 136

<211> 18

<212> DNA

<213> Artificial Sequence

<220>

<221> Any

<222> 7..9

<223> Oligonucleotide to act as a PCR primer

<400> 136

ggcgcgnnna tctacccg

18

<210> 137

<211> 18

<212> DNA

<213> Artificial Sequence

<220>

<221> Any

<222> 7..9

<223> Oligonucleotide to act as a PCR primer

<400> 137

aacggcnng gcgagtgc

18

<210> 138

<211> 18

<212> DNA

<213> Artificial Sequence

<220>

<221> Any

<222> 7..9

<223> Oligonucleotide to act as a PCR primer

<400> 138

tactacnnnt gctgggag

18

<210> 139

<211> 18

<212> DNA

<213> Artificial Sequence

<220>

<221> Any

<222> 7..9

<223> Oligonucleotide to act as a PCR primer

<400> 139

tacgacnnnt gggagccc

18